vations showed that active or very active nesting occurred 12 times when rice was locally available and 6 times when it was not. On the other hand, only once was nesting *not* recorded when rice was available in local fields. The remaining 13 observations when no, or slight, nesting was recorded, there was no locally available rice. Thus, there was a definite association between STM nesting activity and nearby rice conditions.

It is hoped that the results of this study will lead to a better understanding of the relationships between certain bird species and the rice crop in Malaysia, and that these results will provide a basis for further studies.

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18. NOTES ON SEXING CROCODILIANS

(With two plates)

The need for sexing crocodilians for captive propagation or for release is self evident. Several authors have reported the effectiveness of the simple cloacal probe technique. The crocodile is held and turned on its back. The cloacal area is cleaned with water, finger (close-cropped nail advisable) is inserted to feel for the presence or absence of the penis.

Male crocodilians possess a single organ, rooted to the interior ventral wall of the cloaca immediately anterior to the anal vent. Normal rigidity of the organ permits contact when probed at a depth of 8 centimetres or less in an animal 3 to 4 metres in length. The absence of a rigid organ within the cloaca of the female reveals only a vacant chamber when probed. The small flaccid clitoris of the female cannot easily be confounded with the penis of the male if a minimum specimen size limitation of 75 cm is observed, particularly when dealing with individuals of the genus *Tomistoma* and *Gavialis* (Brazaitis 1968).

With smaller mugger (70-80 cm) it is often impossible to insert a finger. However the penis was extrudable by applying digital pressure on both sides of the cloaca while bending the animal's tail upwards (plate I).

Mugger (*C. palustris*) of under 80 cm are difficult to sex. The cloacal opening is small, the clitoris and penal tip are extrudable and look alike. As they grow larger the clitoris is no longer extrudable while the penis grows and continues to be extrudable manually. At 2.5 metres (near breeding size for the male) the penis will extrude approximately 10 cm and is about 3 cm in diameter.

Crocodylus porosus is similar in structure and development rate to the mugger. Animals of 90 cm can be reliably sexed using the fifth finger (small opening).

There is little in the literature on sexing *Gavialis gangeticus*. Our experience in examining 20 *Gavialis* from 1 m (2 years) to nearly 3 m (20 years) suggest that this animal has a slower rate of sexual development than the other two Indian crocodilians. In none of the gharial checked was the penis more than a few centimetres in length though the 2.7 m specimen was over 12 years of age (plates). Captivity (diet, metabolism, enclosure, disturbance)

places some developmental limits but one captive male (Nandankanan, Orissa) of about 2.5 m is reported to be developed "normally" by other known crocodilian standards (H. R. Bustard, *pers. comm.*). The specimen is not particularly old (12-15 years) but has a well-developed "ghara" over its nostrils (plate). The ghara is interpreted to be a dimorphic male character (Martin and Bellairs 1977) and may indicate sexual maturity.

At the Crocodile Bank we have 6 gharial ranging from two 1.2 metres 2 year old to a 2.7 m, 18 year old male. After the February 1978 IUCN/SSC Crocodile Specialist Group Meeting, several of the specialists worked with us checking the lower size limit for sexing young mugger and sexing the gharial. In discussion it was felt that the non-breeding of this crocodilian in captivity is at least partly due to the difficulty in sexing them. The Table gives the basic details of the *Gavialis* checked.

	Year	Approx. Age	Place	Size	Sex	Notes
1.	1974	10	Mysore Zoo	2.8m	♂	No ghara, penis small, distinguishable.
2.	1974	10	Mysore Zoo	2.7m	♀	Smooth cloacal wall with small clitoris
3.	1974	3	Mysore Zoo	1.2m	♀?	At this size sex probably not determinable
4.	1975	2	Madras Crocodile Bank	1.2m	♂?	In 1975 it was sexed as a female; in 1978 (at 2 m) it is apparently a male!
5.	1975	3	Madras Crocodile Bank	1.6m	♂	Penis small but distinguishable.
6.	1977	10+	Ahmedabad Zoo	2.5m	♂	Thought to be a female and penis not detected at first check. Upon rechecking confirmed to be a male (at 2.7 m).
7.	1977	20+	Calcutta Zoo	2.5m	♀	Smooth, wide cloaca with small clitoris about six cm inside on anterior wall.
8.	1977	2	Madras Crocodile Bank	1.1m	♀?	At this size sex probably not determinable.
9.	1977	2	Madras Crocodile Bank	1.2m	?	Sex not determinable.
10.	1978	7+	Patna Zoo	2.3m	♂	No ghara, penis small but distinguishable.
11 to 20.	1978	2, 3	Gharial Project, Kukkrail, Uttar Pradesh	1–1.6m	?	Cloacal opening small and sexes undistinguishable.

Discussion: If further studies on sexing gharial confirm the difficulties mentioned above, other methods of sex determination must be investigated. Bellairs (THE LIFE OF REPTILES, 1969) mentions that karotyping may not work in crocodilians (*Gavialis?*) but other sex characters may come to light. This problem attains more importance considering that recent research indicates that egg incubation temperature influences the sex ratio of crocodilian offspring and the need in release programmes to stock a suitable ratio.

Demonstrating the technique of sexing a juvenile *C. palustris* of 80 cm by tail bending and pressure on sides of cloaca.

Close up of extruded penis of *C. palustris*.